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SPECTROSCOPIC DETERMINATION OF THE ELECTROSTATIC  
POTENTIAL PROFILE IN A PLASMA PREFILLED ION DIODE

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abstract only

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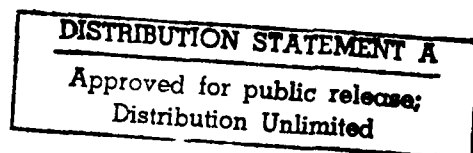
A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy



by

Michael D. Coleman

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**ELECTROSTATIC  
ED ION DIODE**

**Cornell University 1989**

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The electrostatic potential,  $\Phi$ , as a function of distance from the anode,  $x$ , has been inferred from measurement of the velocity of the ions as a function of distance from the anode,  $v(x)$ , with the equation  $\Phi(x) = -\frac{1}{2}m[v(x)]^2$ . The velocity has been determined from the Doppler shift for resonant absorption of the 4401Å Ar<sup>+</sup> line using LIF.  $\Phi(x)$  profiles have been obtained with varied plasma

prefill density and for diode configurations with and without electron emitting "vanes" on the cathode. In all cases a wide region adjacent to the anode (as much as 8 mm out of 11.5 mm hardware gap) is at anode potential (i.e. the acceleration occurs in a region as small as 3.5 mm adjacent to the cathode). In time dependent measurements of  $\Phi(x)$  the dynamic acceleration region is observed to expand towards the anode. With no vanes on the cathode (a planar diode gap), the observed  $\Phi(x)$  profile is clearly inconsistent with simple analytic models for planar MID's, but is consistent with the assumption of uniform electron density between the cathode and the anode plasma surface. The  $\Phi(x)$  profiles obtained with an electron emitting vane on the cathode do not agree with the predictions of a particle in cell computer simulation performed for a similar geometry.